

Amendments to the Claims:

The following listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Original) A halftone generation system for generating halftone data of a pixel based on comparison between multilevel image data of the pixel and threshold matrix data, said halftone generation system comprising:

threshold matrix data storage means for storing threshold matrix data;

threshold data read means for reading all threshold data applied to halftone data generation processing for one scanning line from said threshold matrix data storage means;

first register means for retaining all the read threshold data applied to halftone data generation processing for the scanning line;

threshold data selection means for selecting a plurality of threshold data pieces from among all the threshold data pieces applied to halftone data generation processing for the scanning line retained in said first register means and outputting the selected threshold data pieces; and

a plurality of comparison means for performing comparison processing between the threshold data pieces selected by said threshold data selection means and multilevel image data of a plurality of pixels in parallel and executing parallel generation processing of halftone data of the pixels.

2. (Original) A halftone generation system for generating halftone data of a pixel based on comparison between multilevel image data of the pixel and threshold matrix data in painting object units,

said halftone generation system comprising:

threshold matrix data storage means for storing threshold matrix data;

threshold data read means for reading all threshold data applied to halftone data generation processing for one scanning line from said threshold matrix data storage means in response to the start position of a painting object;

first register means for retaining all the read threshold data applied to halftone data generation processing for the scanning line;

threshold data selection means for selecting a plurality of threshold data pieces from among all the threshold data applied to halftone data generation processing for the scanning line retained in said first register means and outputting the selected threshold data pieces; and

a plurality of comparison means for performing comparison processing between the threshold data pieces selected by said threshold data selection means and multilevel image data of a plurality of pixels in parallel and executing parallel generation processing of halftone data of the pixels.

3. (Currently Amended) The halftone generation system as claimed in claim 1, wherein

said threshold data read means comprises; second register means for retaining all threshold data applied to halftone data generation processing for the scanning line to be processed next to the current scanning line where halftone data generation processing is being executed,

said threshold data read means reads all threshold data applied to halftone data generation processing for the scanning line to be processed next to the current scanning line from said threshold matrix data storage means, and outputs the read threshold data to said second register means, and

the threshold data retained in said second register means is output to said first register means.

4. (Original) The halftone generation system as claimed in claim 3, wherein the parallel generation processing of halftone data of the pixels in said plurality of comparison means and the reading of all threshold data applied to halftone data generation processing for the scanning line to be processed next to the current scanning line from said threshold matrix data storage means, and the output processing of the read threshold data to said second register means in said threshold data read means are performed in parallel.

5. (Previously Presented) The halftone generation system as claimed in claim 1, wherein

said threshold data selection means comprises; as many selector circuits as the number of halftone data pieces generated in parallel in said plurality of comparison means, and

input of each of said selector circuits is connected to output of said first register means at intervals of as many as the number of halftone data pieces generated in parallel in said plurality of comparison means, and output of each of the selector circuits is switched in response to the pixel position of halftone data generated in parallel.

6. (Original) The halftone generation system as claimed in claim 5, wherein said first register means comprises; a shift circuit for circularly shifting the retained threshold data, and

said shift circuit shifts the retained threshold data by as many threshold data pieces as the number of threshold data pieces in said first register means not output through said selector circuits to said plurality of comparison means.

7. (Original) The halftone generation system as claimed in claim 5 wherein said first register means comprises; a first register at the preceding stage, and a first register at the following stage,

input of each of said selector circuits is connected to output of said first register at the following stage at intervals of as many as the number of halftone data pieces generated in parallel in said plurality of comparison means,

said first register at the preceding stage comprises; a shift circuit for circularly shifting the retained threshold data,

said shift circuit shifts the retained threshold data in said first register at the preceding stage by as many threshold data pieces as the number of threshold data pieces in said first register at the following stage not output through said selector circuits to said plurality of comparison means, and

the threshold data shifted in said first register at the preceding stage is output to said first register at the following stage.

8. (Original) The halftone generation system as claimed in claim 7, wherein the parallel generation processing of halftone data of the pixels in said plurality of comparison means, and the threshold data shift processing in said first register at the preceding stage are performed in parallel.

9. (Previously Presented) The halftone generation system as claimed in claim 3, wherein

said threshold data read means outputs a shift signal for specifying a threshold data shift amount for said second register means, and

the shift signal indicates the shift amount for causing a start position of a painting object and a threshold data storage location to match.

10. (Original) The halftone generation system as claimed in claim 9, wherein
said second register means comprises; a second register at the preceding stage,
and a second register at the following stage,

the threshold data read from said threshold matrix data storage means is
retained in said second register at the preceding stage, then is output to the second register at
the following stage,

said threshold data read means outputs a shift signal for specifying a threshold
data shift amount for said second register at the following stage,

said second register at the following stage shifts the retained threshold data in
response to the shift signal, and

the threshold data shifted in said second register at the following stage is
output to said first register means.

11. (Original) The halftone generation system as claimed in claim 10, wherein
the parallel generation processing of halftone data of the pixels in said
plurality of comparison means, and the threshold data shift processing in said second register
at the following stage are performed in parallel.

12. (Original) The halftone generation system as claimed in claim 2, wherein
said threshold data read means controls the number of threshold data pieces to
be read from said threshold matrix data storage means in response to the number of pixels of
a painting object on a scanning line to which processing is applied.

13. (Previously Presented) The halftone generation system as claimed in claim 1,
wherein

said threshold data read means reads a plurality of threshold data pieces at the
same time from said threshold matrix data storage means.

14. (Currently Amended) A halftone generation method for generating halftone data of a pixel based on comparison between multilevel image data of the pixel and threshold matrix data,

said halftone generation method comprising:

~~the~~a threshold data read step of reading all threshold data applied to halftone data generation processing for one scanning line from threshold matrix data storage means;

~~the~~a step of retaining all the read threshold data applied to half tone data generation processing for the scanning line in first register means;

~~the~~a threshold data selection step of selecting a plurality of threshold data pieces from among all the threshold data applied to halftone data generation processing for the scanning line retained in said first register means and outputting the selected threshold data pieces; and

~~the~~a comparison step in a plurality of comparison means for performing comparison processing between the threshold data pieces selected at said threshold data selection step and multilevel image data of a plurality of pixels in parallel and executing parallel generation processing of halftone data of the pixels.

15. (Currently Amended) A halftone generation method for generating halftone data of a pixel based on comparison between multilevel image data of the pixel and threshold matrix data in painting object units,

said halftone generation method comprising:

~~the~~a threshold data read step of reading all threshold data applied to halftone data generation processing for one scanning line from threshold matrix data storage means in response to the start position of a painting object;

~~the~~a step of retaining all the read threshold data applied to halftone data generation processing for the scanning line in first register means;

thea threshold data selection step of selecting a plurality of threshold data pieces from among all the threshold data applied to halftone data generation processing for the scanning line retained in said first register means and outputting the selected threshold data pieces; and

thea comparison step in a plurality of comparison means for performing comparison processing between the threshold data pieces selected at said threshold data selection step and multilevel image data of a plurality of pixels in parallel; and executing parallel generation processing of halftone data of the pixels.

16. (Previously Presented) The halftone generation method as claimed in claim 14, wherein

said threshold data read means reads all threshold data applied to halftone data generation processing for the scanning line to be processed next to the current scanning line where halftone data generation processing is being executed from the threshold matrix data storage means and outputs the read threshold data to second register means, and

the threshold data retained in said second register means is output to said first register means.

17. (Original) The halftone generation method as claimed in claim 16, wherein the parallel generation processing of halftone data of the pixels in said plurality of comparison means and the reading of all threshold data applied to halftone data generation processing for the scanning line to be processed next to the current scanning line from said threshold matrix data storage means and the output processing of the read threshold data to said second register means in said threshold data read means are performed in parallel.

18. (Original) A halftone generation system for comparing pixel data forming a multilevel image with threshold matrix data, thereby generating halftone data based on the pixel data of the multilevel image,

said halftone generation system comprising:

threshold data read means for reading all threshold data applied to a scanning line for generating a halftone in batch from threshold matrix data storage means for storing threshold matrix data;

threshold data selection means for selecting a plurality of threshold data pieces corresponding to positions of a plurality of pixels for which a halftone is to be generated from among the threshold data pieces read by said threshold data read means and outputting the selected threshold data pieces; and

comparison means for performing comparison processing between the pixel data pieces for which a halftone is to be generated and the threshold data pieces selected by said threshold data selection means in parallel and generating a plurality of halftone data pieces at the same time.

19. (Original) A halftone generation system for comparing pixel data forming a multilevel image with threshold matrix data so as to generate halftone data based on the pixel data of the multilevel image,

said halftone generation system comprising:

threshold data read means for reading all threshold data applied to a scanning line for generating a halftone in batch from threshold matrix data storage means for storing threshold matrix data;

first register means for temporarily retaining all threshold data corresponding to the scanning line read by said threshold data read means;

threshold data selection means for selecting a plurality of threshold data pieces corresponding to positions of a plurality of pixels for which a halftone is to be generated from among all the threshold data pieces corresponding to the scanning line retained in said first register means and outputting the selected threshold data pieces;

second register means for temporarily retaining the selected and output threshold data pieces; and

comparison means for performing comparison processing between the pixel data pieces for which a halftone is to be generated and the threshold data pieces retained in said second register means in parallel and generating a plurality of halftone data pieces at the same time, wherein

the threshold data read processing performed by said threshold data read means, the threshold data selection processing performed by said threshold data selection means, and the halftone data generation processing performed by said comparison means are executed in parallel as pipeline processing in units of pixels.

20. (Previously Presented) The halftone generation system as claimed in claim 18, wherein

said threshold data read means reads all threshold data applied to the scanning line for generating a halftone from said threshold matrix data storage means for storing threshold matrix data by accessing memory once.

21. (Previously Presented) The halftone generation system as claimed in claim 18, wherein

when the number of all threshold data pieces contained in the scanning line for processing is M , the number of pixels of halftone data generated at the same time is P , and the start pixel position of selected threshold data is S ,

said threshold data selection means selects P consecutive threshold data pieces containing the S 'th threshold data piece from the top as the start position from among the M threshold data pieces and outputs the selected threshold data pieces and if the number of the S 'th threshold data piece and the later of the M threshold data pieces is less than P , said threshold data selection means selects the S 'th threshold data piece and the later plus the

threshold data pieces consecutive starting at the top of the threshold data and outputs a total of P threshold data pieces.

22. (Previously Presented) The halftone generation system as claimed in claim 18, wherein

said threshold data selection means selects or sorts all threshold data applied to the scanning line read by said threshold data read means in an arbitrary order responsive to the pixel position of generated halftone and outputs the threshold data.

23. (Original) The halftone generation system as claimed in claim 22, wherein
said threshold data selection means outputs at the same output timing, a number of threshold data pieces equal to or less than the number of threshold data pieces undergoing comparison processing in parallel in said comparison means.

24. (Previously Presented) The halftone generation system as claimed in claim 18, wherein

said threshold data selection means comprises; a crossbar switch circuit, and a switch control circuit for controlling said crossbar switch circuit,

when the number of all threshold data pieces contained in the scanning line for processing is M, said crossbar switch circuit can input all M threshold data pieces at the same time, and

said switch control circuit controls said crossbar switch circuit so as to select only the threshold data corresponding to the pixel position of generated halftone from among the M threshold data pieces input to said crossbar switch circuit and output to the selected threshold data.

25. (Previously Presented) The halftone generation system as claimed in claim 18, wherein

said threshold data selection means comprises; a barrel shifter circuit and a shift control circuit for controlling the shift amount of the barrel shifter circuit,

when the number of all threshold data pieces contained in the scanning line for processing is M, the barrel shifter circuit can input all M threshold data pieces at the same time,

said shifter control circuit controls the shift amount of the M threshold data pieces input to said barrel shifter circuit in response to the pixel position of generated halftone.

26. (Original) The halftone generation system as claimed in claim 24, wherein said threshold data selection means further comprises:

a multiplexer circuit for sorting M threshold data pieces divided into blocks each consisting of a plurality of threshold data pieces in block units; and

block-unit threshold data register means for temporarily retaining the M threshold data pieces sorted in block units by said multiplexer circuit, and

said crossbar switch circuit inputs the threshold data pieces sorted in block units and retained in said block-unit threshold data register means.

27. (Original) The halftone generation system as claimed in claim 25, wherein said threshold data selection means further comprises:

a multiplexer circuit for sorting M threshold data pieces divided into blocks each consisting of a plurality of threshold data pieces in block units; and

block-unit threshold data register means for temporarily retaining the M threshold data pieces sorted in block units by said multiplexer circuit,

said barrel shifter circuit inputs the threshold data pieces sorted in block units and retained in said block-unit threshold data register means.

28. (Previously Presented) The halftone generation system as claimed in claim 25, wherein

said barrel shifter circuit forming a part of said threshold data selection means comprises; a right barrel shifter circuit which inputs the M threshold data pieces and can shift the data only right, and a left barrel shifter circuit which inputs the M threshold data pieces and can shift the data only left in combination, and

said threshold data selection means further comprises; a selector circuit for selecting the threshold data output from either said right or left barrel shifter circuit.

29. (Currently Amended) A halftone generation method for comparing pixel data forming a multilevel image with threshold matrix data so as to generate halftone data based on the pixel data of the multilevel image,

said halftone generation method comprising:

~~the~~ threshold data read step of reading all threshold data applied to a scanning line for generating a halftone in batch from threshold matrix data storage means for storing threshold matrix data;

~~the~~ threshold data selection step of selecting a plurality of threshold data pieces corresponding to positions of a plurality of pixels for which a halftone is to be generated from among the threshold data pieces read at the threshold data read step and outputting the selected threshold data pieces; and

~~the~~ comparison step of performing comparison processing between the pixel data pieces for which a halftone is to be generated and the threshold data pieces selected at the threshold data selection step in parallel and generating a plurality of halftone data pieces at the same time.

30. (Currently Amended) A halftone generation method for comparing pixel data forming a multilevel image with threshold matrix data so as to generate halftone data based on the pixel data of the multilevel image,

said halftone generation method comprising:

thea threshold data read step of reading all threshold data applied to a scanning line for generating a halftone in batch from threshold matrix data storage means for storing threshold matrix data;

thea step of temporarily retaining all threshold data corresponding to the scanning line read at said threshold data read step in first register means;

thea threshold data selection step of selecting a plurality of threshold data pieces corresponding to positions of a plurality of pixels for which halftone is to be generated from among all the threshold data pieces corresponding to the scanning line retained in said first register means and outputting the selected threshold data pieces;

thea step of temporarily retaining the selected threshold data pieces in second register means; and

thea comparison step of performing comparison processing between the pixel data pieces for which a halftone is to be generated and the threshold data pieces retained in said second register means in parallel and generating a plurality of halftone data pieces at the same time, wherein

the threshold data read processing performed at said threshold data read step,

the threshold data selection processing performed at said threshold data selection step, and

the halftone data generation processing performed at said comparison step are executed in parallel as pipeline processing in units of pixels.

31. (Previously Presented) The halftone generation method as claimed in claim 29, wherein

the threshold data selection step selects or sorts all threshold data applied to the scanning line read at the threshold data read step in an arbitrary order responsive to the pixel position of generated halftone and outputs the threshold data.

32. (Previously Presented) The halftone generation method as claimed in claim 29, wherein

said threshold data selection step further comprises:

the step of sorting threshold data pieces divided into blocks each consisting of a plurality of threshold data pieces in block units; and

the step of selecting or sorting the threshold data pieces sorted into block units in threshold data units and outputting the threshold data.

33. (Original) A halftone generation system for simultaneously generating halftone data of a plurality of pixels for each painting object of text and graphics, said halftone generation system comprising:

data storage means for storing binary matrix data pieces equal in number to the tone values formed by binarizing all the tone values of a painting object to be processed;

data reading means for reading a predetermined amount of binary matrix data pieces of a scan line under processing from said data storage means in accordance with tone information and pixel position information of a painting object under processing; and

data select means for selecting binary matrix data of a plurality of pixels from the binary matrix data read out of said data reading means in accordance with main-scanning direction pixel position information of a painting object under processing, and outputting the resultant.

34. (Original) A halftone generation system which simultaneously generates halftone data of a plurality of pixels for each painting object of text and graphics, and then simultaneously writes the halftone data of a plurality of pixels into an output buffer memory, said halftone generation system comprising:

data storage means for storing binary matrix data pieces equal in number to the tone values formed by binarizing all the tone values of a painting object to be processed;

data reading means for reading a predetermined amount of binary matrix data pieces of a scan line under processing from said data storage means in accordance with tone information and pixel position information of a painting object under processing;

data select means for selecting binary matrix data of a plurality of pixels from the binary matrix data read out of said data reading means in accordance with main-scanning direction pixel position information of a painting object under processing, and outputting the resultant; and

means for writing data representative of the result of ANDing the binary matrix data read out of said data select means and mask data indicative of a paint-out area of the painting object into the output buffer memory.

35. (Original) The halftone generation system as claimed in claim 33, wherein said data reading means simultaneously reads out all the binary matrix data pieces of a scan line under processing from said data storage means in accordance with sub-scanning direction pixel position information of a painting object under processing.

36. (Original) The halftone generation system as claimed in claim 33, wherein said data reading means reads out the binary matrix data pieces of a scan line under processing from said data storage means in accordance with main-scanning and sub-scanning direction pixel position information of a painting object under processing.

37. (Original) The halftone generation system as claimed in claim 33, wherein

said data select means successively shifts the binary matrix data read out by
said data reading means till a halftone data generation process of a scan line under processing
ends in execution thereof, in accordance with a shift of a main-scanning direction pixel
position of the painting object to a main-scanning direction pixel position of the binary matrix
data.